Drexel Object Occlusion Repository (DOOR)

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Drexel Object Occlusion Repository (DOOR)

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Abstract

The Drexel Object Occlusion Repository is a reference set of images for computer vision and object recognition researchers. The images are constructed by overlapping input objects from the COIL-20 database [1] and occluding them by various amounts. The amount of occlusion for each image is measured at the pixel level. An accompanying text file for each occlusion image describes the input files, occlusion rates etc.

Figure 1. Occlusion example door_4_41.png

1. Overview

The Drexel Object Occlusion Repository is a syntactic set of images constructed from the COIL-20 database from Columbia University [1]. In a previous work [2] our tests with the COIL-20 database indicated a need for a set of reference scenes where we could test the ability of our algorithm to locate objects in scenes where the objects are partially occluded. In particular we required a precise measurement of the occlusion rates in addition to non-trivial occlusions. To accomplish these goals we have constructed the Drexel Object Occlusion Repository. The repository contains objects deterministically placed in groupings with varying amounts of occlusion. The repository

provides a reference set that researchers in computer vision and object recognition may use for qualitative analysis of algorithmic performance.

The repository is organized into four series of images. Series one contains images with two objects, series two with three objects, series three with four objects and, lastly, series four with five objects. Each series contains 480 images and accompanying text files. The text files include various information about the image including, the name of the objects and percentage of occluded pixels in each of the objects.

2. Drexel Object Occlusion Repository (DOOR)

2.1. Construction

The occluded images consist of a composed set of objects from the COIL-20 database. The objects have not been scaled or rotated, although we plan to expand to the repository in the future to include objects which have been transformed in the image plane. When composing two objects we first create a mask for each image. The background for the image is created by filling edge pixels with red. Then the non-red pixels in the mask are set to green, which designates them as object pixels. The red/green masks for the input image and the occlusion image are then convoluted with a Gaussian. The masks are used to combine the original images. If the pixel is an edge pixel the intensity, I, is given by

$$I = R * R' + G * G',$$

where R, G are the red and green channels of the input image mask and R', G' are the red and green channels of the mask of the image being constructed (occlusion image). This is similar to using an alpha channel for the mixing. For more information on the use of alpha channels consult an appropriate image processing text. After placing an object on the image the amount of occlusion for each object in the image is updated. A pixel is considered occluded if it has been covered by another object, or if it on the border between two objects.

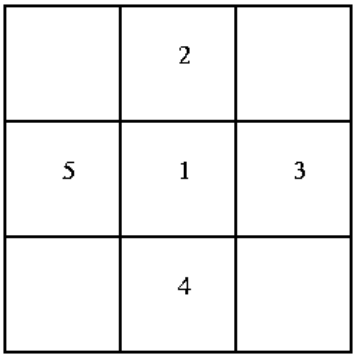

Figure 2. Object Layout Grid

In general the objects contained in each image are arranged in a grid shown in Figure 2. For each image an object is placed in the center at position one. Objects are then added at the other positions at varying distances from the center object. As the objects move farther away from the center the amount of occlusion of the center object decreases.

2.2. Contents of the Accompanying Text Files

Each image is accompanied by a text file that provides information about the various objects in the image. The following text file describes image forty-one in series four (shown in Figure 1).

```
Input File1: coil-20-proc/obj1__0.png
Input File3: coil-20-proc/obj12__0.png
Input File4: coil-20-proc/obj13__0.png
Input File5: coil-20-proc/obj14__0.png
Input File2: coil-20-proc/obj15__0.png
Output File: door_4/0-99/door_4_41.png
Gaussian_radius=3
Gaussian_sigma=2
Border=10
Width=592
Height=592
Object=1 file=coil-20-proc/obj1__0.png x=222 y=222 occlusion=16.20 oldpixels=6668 newpixels=5588
Object=2 file=coil-20-proc/obj15__0.png x=222 y=122 occlusion=0.00 oldpixels=11697 newpixels=11697
Object=3 file=coil-20-proc/obj12__0.png x=322 y=222 occlusion=0.00 oldpixels=9975 newpixels=9975
Object=4 file=coil-20-proc/obj13__0.png x=222 y=322 occlusion=0.00 oldpixels=7751 newpixels=7751
Object=5 file=coil-20-proc/obj14__0.png x=122 y=222 occlusion=0.00 oldpixels=11826 newpixels=11826
```

The file lists the image files of the objects at the various grid positions. Next the file contains the parameters of the Gaussian convolution kernel used to combine the two images at the borders. Many images in the COIL-20 database are cropped such that the object lies on the edge of the image. Prior to composing the objects in the image we first add a border to each image. The size of this border is reported in the text file. Lastly the file contains the position of the $(0, 0)$ pixel of each object in the image, as well as the percent of pixels that have been occluded. In this particular example object one has had 16.2% of its pixels occluded.

3. Query Tool

A query tool is provided to assist the researcher in finding occlusion images.

```
./query_door.pl [OPTIONS]

DESCRIPTION: This program queries a DOOD data file for objects that have
certain amounts of occlusion. It prints the names of the files that meet the criteria.

OPTIONS
   -help                show this help
   -data=PATH           path to DOOR data file (door_all.txt)
   -min=NUMBER          minimum occlusion (0.0)
   -max=NUMBER          maximum occlusion (10.0)
   -obj=PATTERN         pattern for object selection (obj*)

Example:

./query_door.pl -min=9.9 -max=10.2 -obj=obj13.*
Finds examples of object 13 that are occluded by 9.9-10.2% using the data
from the file door_all.txt.

./query_door.pl -min=19.9 -max=20.2
Finds examples of objects that are occluded by 19.9-20.2% using the data
from the file door_all.txt.
```

4. Obtaining the Repository

The repository is on-line at http://aal.cs.drexel.edu/home/door/index.html. A gzipped tar file is available on the website as well.

5. Acknowledgments

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References

[1] S. Nene, S. Nayar, and H. Murase. Columbia object image library: Coil, 1996.

[2] J. Novatnack, T. Denton, A. Shokoufandeh, and L. Bretzner. Stable bounded canonical sets and image matching. In *Proceedings, Workshop on Energy Minimization Methods in Computer Vision and Pattern Recognition (EMMCVPR). (To Appear)*, 2005.